Social housing and socio-spatial segregation in the city of Bogotá, Colombia. Contradictions in the social housing market.

S50 Social Housing and Socio-Spatial Segregation: New Challenges in Urban Planning

Abstract

Segregation has been a process inherent to urban growth processes, both from a functional and social perspective, manifested in the differential location of social groups (Rodríguez and Arriagada, 2004). Although agglomeration is beneficial for economic and urban growth, as proposed by Marshall at the end of the 19th century, this driver of city growth can produce negative effects due to its connection with conditions of unequal access to the benefits of urbanization (Hernández, 2017). In this sense, socio-spatial segregation is expressed in cities through an unequal distribution of social groups, which leads to unequal access to land and urban infrastructure.

In the context of the Latin American cities, Janoschka (2002) also suggests that new urban forms have a markedly insular character because they are structured as relatively homogeneous socioeconomic islands, possibly close but separated by a sea of limits and obstacles. Socioeconomic residential segregation thus denotes the unequal distribution of socioeconomic groups, and consequently, the patterns of agglomeration and geographical distance between them. Meanwhile, the scale of segregation increases as different socioeconomic groups reside at greater distances from each other (Rodríguez, 2017). This segregation can occur due to a daily disconnection between socioeconomic groups who, in addition to living separately, lack shared workspaces, common routes or trajectories, or physical meeting areas in the city. This results from two key factors: 1) the greater distance of the poor from their workplaces; and 2) the poor's dependence on public transportation (Rodríguez, 2008). In summary, understanding socio-spatial segregation processes as a condition associated with structural factors in the urban development of Latin American cities, which force the location of poorer social groups in border areas far from the central areas of cities, the discussion about the impact on these processes of the dynamics of the land market for social housing is relevant.

Clearly, to understand why housing can constitute an element of segregation, it is necessary to assume that it is an object of consumption, affected by issues of urban income associated with land use in cities. Therefore, its acquisition depends on a payment capacity in relation to the costs represented by its production and the value of the land (Hernández, 2017).

Consequently, the research questions guiding this paper is how does the Social Housing (VIS for its Spanish acronym) market impact the patterns of socio-spatial segregation in urban border territories in Bogotá, Colombia? specifically in the Usme sector, to the southeast of the city. Two control cases are also taken, corresponding to formal social housing projects in other borders of the city. Likewise, another research question emerges: how does the production of VIS contribute to the reduction of

socio-spatial segregation? or if, on the contrary, is this housing supply contributing to accelerate these processes? Therefore, it seeks to verify how the supply of social housing is largely subject to the dynamics of the real estate market, especially due to the high value of urban land. Consequently, this housing tends to be located in the lowest-priced lands in cities, many of them border territories, reproducing patterns of socio-spatial segregation and structural conditions of socioeconomic marginality.

The history of social housing in Colombia is directly related, among other aspects, to the urban and migratory growth of large cities. However, the 1991 Constitution established the constitutional right to decent housing, which favorably expanded its conception to a reflection of housing and environment, which introduces a review from the project to access to goods and services, accessibility, mobility, and spatial justice, and from habitability to adequate conditions and quality of the built domestic habitat. All these aspects end up being less representative in the profitability of land for real estate production. In this sense, "tensions arise from the confrontation between two conceptions of the mass production of social housing, which originate in the power plays of the major actors in urban development and reveal strong divergences on how to apply the regulatory instruments provided by law" (Beuf and García, 2016, p. 394).

The methodology is proposed from a multidimensional and multi-scalar approach with the use of quantitative methods, from the formulation of an index to measure the socio-spatial segregation associated with this model of social housing production. The construction of the Socio-Spatial Segregation Index (hereinafter ISES) seeks the inclusion of different dimensions of urban life that synthesize the complex phenomenon of segregation without being limited to a simple measure of population distribution. This composite index aims to capture five dimensions that, in the strict sense, are desirable for social integration in the city, and therefore, are considered contrary to segregation; thus, in the formal expression of the ISES these five dimensions. In an additive way, these five dimensions (evaluated from 0 to 1) are measured. The ISES index and its five (5) sub-indices are defined according to equation 1.

$$ISESj_i = -1(FURj_i + MURj_i + SAMBj_i + KHj_i + CONj_i) \quad (1)$$

In (1):

ISES= Socio-spatial segregation index
FUR= Urban Functionality
MUR= Urban Morphology
SAMB= Environmental Services
KH = Human Capital
CON = Connectivity
j = 15-minute pedestrian isochrone
i = Housing project case study

For the compilation and calculation of the index in the study and control cases, isochrones are defined that consider a radius of 15 minutes walking distance as the unit of analysis, on which the calculation of each sub-index is based, which are described below:

Urban Functionality (FUR) is a sub-index that measures the vitality and mix of uses in an urban area. The FUR consists of three main components: Economic Diversity according to land uses (Div), the Location Coefficient of land uses (CL), and the Land Value (VSm²). Equation 2.

$$FUR = \frac{1}{3}Div_{ji} + \frac{1}{3}CL_{ji_x} + \frac{1}{3}VSm^2{}_{ji} \qquad (2)$$

Urban Morphology (MUR) is defined from what is understood as a compact formal city. The MUR consists of variables such as public space and buildability. The sub-index is composed of five components: the Proportion of road infrastructure (Propvias) and public space (PropEP) plus the Proportion of urban land (propSU) multiplied by the average Construction Index (IC) minus the Proportion of informal land (PropourbInf). In this way, the morphological consolidation of the territory decreases as informality increases, so the result on the variable of informal urban growth is subtracted. Equation 3.

$$MUR = (\frac{1}{5}Propvias_j + \frac{1}{5}PropEP_j + \frac{1}{5}PropSU_j + \frac{1}{4}EdPj\ ) - \frac{1}{5}PropurbInf_j \quad (3)$$

Environmental Services (SAMB) become relevant when encountering urban border zones, which generate environmental conflicts that are permeated by climate change factors, such as fire hazards, erosion, or flooding. The sub-index consists of three components: Urban tree density (DensArb); environmental conflicts associated with the invasion of water edges (CAzampa); and environmental conflicts associated with climate change scenarios (CAriesgo). Equation 4.

$$SAMBj = (\frac{1}{3}DensArb_j + \frac{1}{3}m^2MAj) - \frac{1}{3}\ m^2CA_{riesgoj} \qquad (4)$$

The Human Capital sub-index refers to the ability of people to carry out productive activities, generate value, and obtain income. It consists of three main components: the population with completed secondary education (Pbachiller); the total population (PT); and the Dependency Ratio (RD), which is the relationship between the population under 15 years and over 65 years divided by the population between 15 and 65 years. Equation 5.

$$KHj = \frac{PBachiller_{20-60añosj}}{PTj} \quad (5)$$

The Urban connectivity emerges as a critical indicator to understand and measure spatial segregation, revealing how transportation infrastructure and accessibility can reproduce or mitigate social inequalities. The analysis of open data allows the identification of mobility patterns that evidence territorial disparities, where the quality and distribution of urban connections not only reflects but also perpetuates socioeconomic differences between different metropolitan areas (Blanco, 2010) (Bernardes, 2020). Differential accessibility to services, infrastructures, and opportunities thus becomes a subtle but powerful mechanism against spatial segregation and mobility between social groups.The *Connectivity index* (CON) has four components. First, the Infrastructure for Mobility component (InfM) is considered, which is subdivided between the proportion of sidewalks and the proportion of roadway of the total area of the isochrone. Second, the coverage component associated with existing public transportation is considered, that is, the destinations of urban bus routes that leave from or pass through the isochrone (CobRBU)[1]. Third, distances to the city's financial centers and employment hubs (distCBD) are considered. Fourth, distances to local and metropolitan scale facilities (distEQ) are considered. Finally, the travel time to a mass transit system station (TETP) is considered. Equation 6.

$$CONj = \frac{1}{5}\ ProInfMj + \frac{1}{5}\ ProCobRBUj - (\frac{1}{5}\ (DistCBDjx) + \frac{1}{5}\left(\frac{1}{n}\ DistEQ\right) + \frac{1}{5}\ T_{ETPj}) \qquad (6)$$

The results show that social housing tends to be located in urban border areas, contributing to processes of socio-spatial segregation of vulnerable communities and thus exacerbating processes of inequity and spatial marginalization, especially due to the absence of good connectivity, aggravated by the greater distance to employment centralities, facilities, and public transport stations. Additionally, the case study shows the persistence of low levels of human capital, as well as greater deficits in the consolidation of urban form, in aspects of territory functionality, manifested in a lower land value. The results also show that the urban border condition in which the case study is located favors the presence of better environmental quality than other points in the city, although areas of environmental conflict persist due to climate change scenarios associated with fires and mass removal processes.

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